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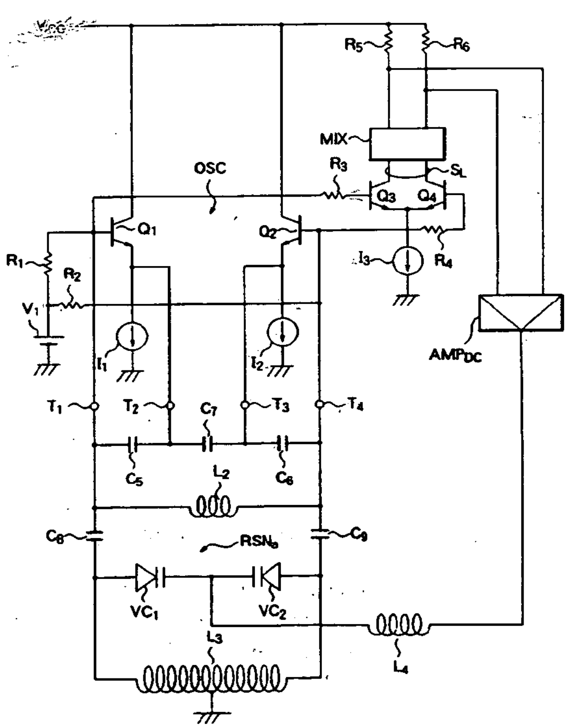
(54) **Oscillator circuit.**

(57) An oscillator is provided with an oscillation circuit including two oscillation transistors (Q_2,Q_1), comprising a differential pair, and a resonance circuit (RSN_a) connected in common to the bases of the oscillation transistors (Q_2,Q_1). The bases of the oscillation transistors (Q_2,Q_1) are short-circuited by a coil (L_2), a center tap coil (L_3) is connected in parallel to the resonance circuit (RSN_a), and variable capacitance diodes (VC_1,VC_2) in the resonance circuit (RSN_a) are driven by a coil (L_4) connected to a mixing circuit (MIX). Due to this, it is possible to prevent the occurrence of low frequency noise, possible to realise a completely balanced operation, possible to avoid the oscillation carrier flowing into the power source and ground, and, when the oscillation circuit is used in a television tuner, possible to reduce the noise in a television picture.

FIG. 2



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BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an oscillator used for a television tuner etc. for receiving a wide frequency band signal.

2. Description of the Related Art

Figure 1 is a circuit diagram showing the basic configuration of this type of oscillator as a related art.

In Fig. 1, OSC represents an oscillation circuit, RSN a resonance circuit, MIX a mixing circuit, and AMP_{DC} a DC amplifier.

The oscillation circuit OSC is integrated and is comprised of npn type transistors Q_1 and Q_2 comprising a differential type Colpitz oscillation circuit, npn type transistors Q_3 and Q_4 comprising a differential output stage, a biasing constant voltage source V_1 of the oscillation npn type transistors Q_1 and Q_2, resistance elements R_1 to R_4, and constant current sources I_1 to I_3.

The base of the oscillation transistor Q_1 is connected to an input/output terminal T_1, is connected through the resistance element R_1 to a line of a constant voltage source V_1, and is connected through the resistance element R_3 to the base of the transistor Q_3. The emitter of the oscillation transistor Q_1 is connected to an input/output terminal T_2 and is connected to the constant current source I_1, which constant current source I_1 is grounded. The collector of the oscillation transistor Q_1 is connected to a line of a power source voltage V_{CC}.

The base of the oscillation transistor Q_2 is connected to an input/output terminal T_4, is connected through the resistance element R_2 to the line of the constant voltage source V_1, and is connected through the resistance element R_4 to the base of the transistor Q_4. The emitter of the oscillation transistor Q_2 is connected to an input/output terminal T_3 and is connected to the constant current source I_2, which constant current source I_2 is grounded. The collector of the oscillation transistor Q_2 is connected to the line of the power source voltage V_{CC}.

The transistors Q_3 and Q_4 are connected at their emitters and a node of the two is connected to the constant current source I_3. The constant current source I_3 is grounded. The collectors of the transistors Q_3 and Q_4 are connected to the input of the mixing circuit MIX.

Further, the output terminals of the mixing circuit MIX are connected through the load resistance elements R_5 and R_6 to the line of the power source voltage V_{CC} and are connected to the input of the DC amplifier AMP_{DC}.

The resonance circuit RSN is comprised of a series circuit of a variable capacitance diode VC_1 and coil L_1 to which are connected in parallel the capacitors C_1 and C_2.

The node between one end of the coil L_1 of the resonance circuit RSN and the capacitors C_1 and C_2 is grounded through the resistance element R_7 of the resistance value of 30 kΩ and is connected to the input/output terminal T_1 (base of oscillation transistor Q_1) through the DC cutting capacitor C_3.

The node between the cathode of the variable capacitance diode VC_1 and the capacitors C_1 and C_2 is connected to the output of the DC amplifier AMP_{DC} through a drive resistance element R_8 of a resistance value of 30 kΩ and is connected to an input/output terminal T_4 (base of oscillation transistor Q_2) throngh a DC cutting capacitor C_4.

Between the input/output terminal T_2 and the node between the capacitor C_3 and the input/output terminal T_1 is connected a positive feedback capacitor C_5 and between the input/output terminal T_3 and the node between the capacitor C_4 and the input/output terminal T_4 is connected a positive feedback capacitor C_6.

Further, between the node of the capacitor C_5 and the input/output terminal T_2 and the node of the capacitor C_6 and the input/output terminal T_3 (between the emitter of the oscillation transistor Q_1 and the emitter of the oscillation transistor Q_2) is connected a coupling capacitor C_7.

Note that the capacitances of the externally provided capacitors C_1 to C_7 are set for example as follows: 1 pF for the capacitor C_1, 13 pF for the capacitor C_2, 56 pF for the capacitors C_3 and C_4, 2 pF for the capacitors C_5 and C_6, and 3 pF for the capacitor C_7.

In such a configuration, the oscillation circuit OSC receives positive feedback from the capacitors C_5 and C_6 connected between the bases and emitters of the oscillation transistors Q_1 and Q_2 through the input/output terminals T_1, T_2, T_3, and T_4, oscillates at the resonance frequency of the resonance circuit RSN connected to the bases of the oscillation transistors Q_1 and Q_2, and outputs the local oscillation frequency signal S_L of a predetermined frequency through the transistors Q_3 and Q_4 to the mixing circuit MIX.

Note that the oscillation transistors Q_1 and Q_2 comprising the differential Colpitz oscillation circuit are connected at their bases through the resonance circuit RSN, so perform oscillation operations with opposite phases.

Accordingly, local oscillation frequency signals S_L with opposite phases are output from the collectors of the transistors Q_3 and Q_4.

When the oscillation circuit of Fig.1 is used in a television tuner, in the mixing circuit MIX, an FM modulated video signal of a selected channel and the local oscillation frequency signal S_L are mixed, and the signal of the frequency of the difference is taken out and is output to the DC amplifier AMP_{DC}. Further,

the resonance circuit RSN is driven through the resistance R_8, by the output of the DC amplifier AMP_{DC}.

That is, after the phase detection by the mixing circuit MIX, the control voltage of the demodulation frequency, which is based on the drive resistance element R_8 and the output of the DC amplifier AMP_{DC}, is supplied to the cathode of the variable capacitance diode VC_1 of the resonance circuit RSN.

Now, if the above-mentioned circuit were to be used as an oscillator for an FM demodulator for satellite broadcasting (BS), the operational frequency would be 400 MHz to 500 MHz.

However, the above-mentioned circuit suffers from the disadvantage that it is not possible to obtain a satisfactory picture since noise of a low frequency band would occur, which could be readily discerned even by the human eye, in the television picture. This is due to the so-called shot noise, flicker noise, or burst noise arising from the construction of the junction portion of the oscillation transistors Q_1 and Q_2 itself and the lattice faults, hot noise due to the resistance elements R_1 and R_2, etc.

Further, the control voltage of the demodulation frequency based on the output of the drive resistance element R_8 and the DC amplifier AMP_{DC} is supplied to the cathode of the variable capacitance diode VC_1 of the resonance circuit RSN, but the resistance value of the drive resistance element R_8 is, as explained above, 30 kΩ, the time constant with the capacitors is large, the drive impedance of the variable capacitance diode VC_1 is high, the frequency characteristics will not be improved, and therefore this becomes a cause behind low frequency noise.

Since the operational frequency is high, about 400 MHz to 500 MHz or so, the oscillation carrier easily flows into the power source and ground and therefore it suffers from the disadvantage that there is a liability of occurrence of a pseudo lock and a beat by the high frequency component.

SUMMARY OF THE INVENTION

The present invention was made in consideration of these circumstances and has as its object to provide an oscillator, for use in a television tuner etc., which reduces noise, operates stably without the oscillation carrier flowing to a power source or ground, can prevent the occurrence of a pseudo lock and high frequency beat even at a weak electric field, and therefore, when used in a television tuner, can improve the quality of a television picture.

According to the present invention, there is provided an oscillator comprising: a differential type amplifier formed by first and second transistors; a resonance circuit, output terminals whereof are connected to bases of the first and second transistors; and a first inductive element connected between the bases of the first and second transistors.

According to the present invention, the bases of the first and second transistors are connected by the first inductive element, so the impedance across the bases becomes low at the time of the oscillation operation and therefore the so-called shot noise, flicker noise, burst noise, etc. arising due to the construction of the junction portion of the first and second transistors themselves or lattice faults are cancelled out and, in a television tuner application, the occurrence of low frequency noise in the television picture can be suppressed.

Preferably, the oscillator further includes a second inductive element connected to the resonance circuit in parallel, a point dividing the inductance thereof into two substantially equal values is grounded.

According to the present invention, the oscillation circuit achieves a completely balanced configuration due to the second inductive element. Accordingly, a stable oscillation operation is achieved without the oscillation carrier flowing into the power source or ground, whereby the occurrence of a pseudo lock or a high frequency beat can be prevented even with a weak electric field.

Also, preferably, the oscillator further includes a mixing circuit having input terminals connected to output terminals of the amplifier, and a third inductance element connected between an output terminal of the mixing circuit and a frequency control terminal of the resonance circuit.

The resonance circuit is driven by a signal which is phase-detected in response to an output signal of the amplifier in the mixing circuit and is applied to the frequency control terminal through the third inductive element.

According to the present invention, the resonance circuit is driven by a low impedance through the third inductive element at a demodulation frequency. Due to this, the frequency characteristics are improved and the occurrence of low frequency noise is suppressed.

Preferably, the resonance circuit includes at least first and second variable capacitive elements oppositely connected in series. The frequency control terminal is provided at a point commonly connected to the variable capacitive elements, to vary the capacitances of the first and second variable capacitive elements in response to a signal from the second inductive element.

Also, preferably, the oscillator further includes a first capacitive element connected between the base and emitter of the first transistor of the amplifier, a second capacitive element connected between the base and emitter of the second transistor of the amplifier, and a third capacitive element connected between the emitters of the first and second transistors.

As the base and emitter of the first transistor are connected by the first capacitive element, the emitter

of the first transistor and the ground are connected by the second capacitive element, the base of the second transistor and the ground are connected by the third capacitive element, and the collector of the first transistor is connected to the ground, the impedance of the second capacitive element and the first inductive element itself can contribute to the oscillation. Further, the grounding points become the third capacitive element and the collector of the first transistor, so there is no effect from the unbalance of the differential pair due to variations in the elements or external noise, and the oscillation operation is controlled by just the peripheral elements of the first transistor at all times.

Alternatively, the oscillator further includes a first capacitive element connected between the base and emitter of the first transistor, a second capacitance element connected between the emitter of the first transistor and ground, and a third capacitive element connected between the base of the second transistor and ground. A collector of the first transistor is connected to ground.

Preferably, the first inductance element has a point where the inductance thereof is divided into two substantially equal values and is connected to ground.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and features of the present invention will become clearer from the following description of preferred embodiments with reference to the accompanying drawings, in which:

Fig. 1 is a circuit diagram showing an example of the configuration of an oscillator of the related art;

Fig. 2 is a circuit diagram showing a first embodiment of the oscillator according to the present invention;

Fig. 3 is a circuit diagram showing a second embodiment of an oscillator according to the present invention; and

Fig. 4 is a circuit diagram showing a third embodiment of an oscillator according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Preferred embodiments of the present invention will now be described.

First Embodiment

Figure 2 is a circuit diagram showing a first embodiment of an oscillator according to the present invention, wherein components the same as those in Fig. 1 showing the related art are shown with the same references.

That is, OSC is an oscillation circuit, RSNa is a resonance circuit, MIX is a mixing circuit, AMP_{DC} is a DC amplifier, L_2 is an oscillation coil, L_3 is a center tap coil, L_4 is a drive/high frequency signal blocking coil, C_5 and C_6 are positive feedback capacitors, and C_7 is a coupling capacitor.

This circuit may be preferably used as an oscillator for an FM demodulator for satellite broadcasting (BS) and operates at a frequency of about 400 MHz to 500 MHz.

The oscillation circuit OSC is integrated and is comprised of npn type transistors Q_1 and Q_2 comprising a differential type Colpitz oscillation circuit, npn type transistors Q_3 and Q_4 comprising a differential output stage, a biasing constant voltage source V_1 of the oscillation npn type transistors Q_1 and Q_2, resistance elements R_1 to R_4, and constant current sources I_1 to I_3.

The base of the oscillation transistor Q_1 is connected to an input/output terminal T_1, is connected through the resistance element R_1 to the constant voltage source V_1, and is connected through the resistance element R_3 to the base of the transistor Q_3. The emitter of the oscillation transistor Q_1 is connected to the input/output terminal T_2 and is connected to the constant current source I_1, which constant current source I_1 is grounded. The collector of the oscillation transistor Q_1 is connected to the line of the power source voltage V_{CC}.

The base of the oscillation transistor Q_2 is connected to the input/output terminal T_4, is connected through the resistance element R_2 to the constant voltage source V_1, and is connected through the resistance element R_4 to the base of the transistor Q_4. The emitter of the oscillation transistor Q_2 is connected to the input/output terminal T_3 and is connected to the constant current source I_2. The constant current source I_2 is grounded. The collector of the oscillation transistor Q_2 is connected to the line of the power source voltage V_{CC}.

Further, the transistors Q_3 and Q_4 are connected at their emitters, the node between the two is connected to the constant current source I_3, and the constant current source I_3 is grounded. Further, the collectors of the transistors Q_3 and Q_4 are connected to the input of the mixing circuit MIX.

Further, the output terminals of the mixing circuit MIX are connected through the load resistance elements R_5 and R_6 to the line of the power source voltage V_{CC} and are connected to the input of the DC amplifier AMP_{DC}.

The resonance circuit RSNa is comprised primarily of the two variable capacitance diodes VC_1 and VC_2 with cathodes connected. The oscillation coil L_2 and the center tap coil L_3 are connected in parallel to these variable capacitance diodes VC_1 and VC_2, while the drive/high frequency signal blocking coil L_4

is connected between the node between the cathodes of the two variable capacitance diodes VC_1 and VC_2 and the output of the DC amplifier AMP_{DC}.

As the oscillation coil L_2, use is made of a coil comprised of for example 2 to 4 turns (l) and of about 20Ω at a frequency of 400 MHz. One end of the oscillation coil L_2 is connected to the node of the input/output terminal T_1 and the positive feedback capacitor C_5, while the other end is connected to the node between the input/output terminal T_4 and the positive feedback capacitor C_6. That is, due to the oscillation coil L_2, the bases of the oscillation transistors Q_1 and Q_2 are connected by a low impedance. Further, the oscillation frequency is determined based on the oscillation coil L_2 and the variable capacitance diodes VC_1 and VC_2. The oscillation frequency f is given by the following formula:

$$f = 1/\{2R(L \cdot CD/2)^{1/2}\} \quad (1)$$

The capacitances of the variable capacitance diodes VC_1 and VC_2 are set to about 10 to 20 pF each. The anode of the variable capacitance diode VC_1 is connected through a coupling capacitor C_8 to the node between one end of the oscillation coil L_2 and the positive feedback capacitor C_5. The anode of the variable capacitance diode VC_2 is connected through a coupling capacitor C_9 to the node between the other end of the oscillation coil L_2 and the positive feedback capacitor C_6.

The capacitances of the coupling capacitors C_8 and C_9 are set to for example 30 to 50 pF.

The center tap coil L_3 used is a coil comprised of for example 10T and of about 200 Ω at a frequency of 400 MHz. That is, $L_3 >> L_2$.

One end of the center tap coil L_3 is connected to the anode of the variable capacitance diode VC_1, while the other end is connected to the anode of the variable capacitance diode VC_2. Further, the center point (tap) is grounded. Due to this, the variable capacitance diodes VC_1 and VC_2 are held at the ground potential.

Note that the impedance of the center tap coil L_3 is sufficiently high with respect to the oscillation frequency f, so there is no need for the center tap to be positioned strictly at the center point of the coil and may be suitably positioned.

Further, as the center tap coil L_3, instead of grounding the center point of one coil, it is also possible to connect two coils of the same number of turns in series and ground the node of the same.

The drive/high frequency signal blocking coil L_4 used is a coil which is for example comprised of 15T and has a high impedance at the oscillation frequency and a low impedance, for example, several tens of ohms, at the demodulation frequency. Further, at the low frequency, for example, less than 100 kHz, it is held to less than 0.063 Ω.

The drive/high frequency signal blocking coil L_4 is connected to the node of the cathodes of the variable capacitance diodes VC_1 and VC_2 at one end and is connected to the output of the DC amplifier AMP_{DC} at the other end.

Next, an explanation will be made of the operation according to the above configuration.

The oscillation circuit OSC functions as a so-called completely balanced type Colpitz oscillation circuit since the center point of the externally provided center tap coil L_3 is grounded.

Such a completely balanced type oscillation circuit OSC receives, in the inductive region of the so-called parallel tank circuit between the oscillation coil L_2 and the variable capacitance diodes VC_1 and VC_2, positive feedback by the capacitors C_5 and C_6 connected between the bases and emitters of the oscillation transistors Q_1 and Q_2 through the input/output terminals T_1, T_2, T_3 and T_4, oscillates at the resonance frequency, and outputs the local oscillation frequency signal S_L of the predetermined frequency to the mixing circuit MIX through the transistors Q_3 and Q_4.

Note that the oscillation transistors Q_1 and Q_2 comprising the differential Colpitz oscillation circuit are connected at their bases through the resonance circuit RSNa, so perform oscillation operations of different phases from each other.

Accordingly, local oscillation frequency signals S_L of opposite phases are output from the collectors of the transistors Q_3 and Q_4.

At this time, the bases of the oscillation transistors Q_1 and Q_2 are connected by the coil L_2 of the low impedance near the oscillation frequency, so the so-called shot noise, flicker noise, burst noise, etc. arising due to the construction of the junction portion of the first and second transistors Q_1 and Q_2 themselves, the hot noise due to the resistance elements R_1 and R_2, etc. are cancelled out and, in a television tuner application, the occurrence of low frequency noise at the television picture can be suppressed.

In a television tuner application, in the mixing circuit MIX, the FM modulated video signal of the selected channel and the local oscillation frequency signal S_L are mixed, and the signal of the frequency of the difference is taken out and is output to the DC amplifier AMP_{DC}. Further, the resonance circuit RSNa is driven through the coil L_4 by the output of the DC amplifier AMP_{DC}.

That is, after phase detection at the mixing circuit MIX, the control voltage of the demodulation frequency, which is based on the output of the coil L_4 and the DC amplifier AMP_{DC}, is supplied to the cathode of the variable capacitance diodes VC_1 and VC_2 of the resonance circuit RSNa. The oscillation circuit OSC finally oscillates locked to a frequency according to the control voltage.

At this time, the coil L_4 is of a high impedance at the oscillation frequency, but is a low impedance, for example, several tens of ohms, at the demodulation frequency, so the frequency characteristics are im-

proved and the occurrence of low frequency noise can be suppressed.

Further, since the oscillation circuit is configured for a complete balance, despite the fact the operational frequency is a high 400 MHz to 500 MHz, it is possible to suppress the flow of the oscillation carrier into the power source and ground and therefore the occurrence of a pseudo lock or a beat due to the high frequency component can be prevented.

As explained above, according to the present invention, the bases of the oscillation transistors Q_1 and Q_2 are connected by the low impedance coil L_2, so the flicker and low frequency noise impedance becomes close to zero and as a result the noise in the television picture can be reduced.

Further, since the center tap coil L_3 is provided, a completely balanced operation can be realised in the oscillation circuit. As a result, stable operation can be realised without the oscillation carrier flowing into the power source and the ground. Further, occurrence of a pseudo lock and high frequency beat can be prevented even in a weak electric field.

In addition, since the variable capacitance diodes VC_1 and VC_2 are driven by the coil L_4, the impedance of the flicker noise region can be kept low and it is possible to suppress low frequency noise.

Second Embodiment

Figure 3 is a circuit diagram showing a second embodiment of the oscillator according to the present invention.

The point of difference between the second embodiment and the first embodiment is that the local oscillation frequency signal S_L of the oscillation circuit OSC is no longer output through the npn type transistors Q_3 and Q_4, connected in parallel to the oscillation transistors Q_1 and Q_2. Instead, npn type transistors Q_5 and Q_6 are connected in series between the oscillation transistors Q_1 and Q_2 and load resistance elements R_{10} and R_{11} connected to the power source voltage V_{CC}, and the local oscillation frequency signal S_L is output from the nodes between the collectors of the npn type transistors Q_5 and Q_6 and the load resistance elements R_{10} and R_{11}.

Further, between the emitters of the oscillation transistors Q_1 and Q_2 and the ground are connected resistance elements R_{12} and R_{13} functioning as current sources.

The emitter of the transistor Q_5 is connected to the collector of the oscillation transistor Q_1, the emitter of the transistor Q_6 is connected to the collector of the oscillation transistor Q_2, and the bases of the two transistors Q_5 and Q_6 are connected to a constant voltage source V_2.

Further, the constant voltage source V_1 is connected to the base of a pnp type transistor P1 the emitter of which is connected to the node of the resistance elements R_1 and R_2 and the collector of which is grounded.

In this configuration as well, a similar operation is performed as in the first embodiment explained above. A similar effect to the effect of the first embodiment explained above is obtained, of course, and there are the advantages that the current consumption can be reduced and the isolation with the mixing circuit MIX can be improved.

Third Embodiment

Figure 4 is a circuit diagram of key parts showing a third embodiment of the oscillator according to the present invention.

The oscillation circuit according to this embodiment differs from the first embodiment and the second embodiment in that the transistors Q_1 and Q_2 comprising the differential pair are not balanced and the oscillator is configured using just the transistor Q_2.

Therefore, an externally provided capacitor C_5 is connected between the input/output terminal T_1 and the ground, a capacitor C_7 is connected between the input/output terminal T_3 and the ground, and the collectors of the transistors Q_1 and Q_2 are grounded.

Further, instead of using the center tap coil L_3, the center point of the oscillation coil L_2 is grounded.

In such a configuration, the capacitor C_7 and the coil L_2 contribute to the impedance of the element itself.

Further, the grounding points become one of the electrodes of the capacitor C_5 and the collector of the transistor Q_1, there is no effect from the imbalance of the differential pair due to variations in the elements or external noise, and the oscillation is controlled at all times by the peripheral elements of the transistor Q_2.

Note that in this embodiment too, like with the first embodiment explained above, the bases of the oscillation transistors Q_1 and Q_2 are connected by the coil L_2, so the flicker and low frequency noise impedance becomes close to zero and as a result, in a television tuner application, the noise of the television picture can be reduced. Further, since the variable capacitance diodes VC_1 and VC_2 are driven by the coil L_4, the impedance of the flicker noise region can be kept low and it is possible to suppress low frequency noise.

As explained above, in an oscillation circuit for a television tuner or the like according to the present invention, the flicker and the low frequency noise impedance become close to zero and as a result the noise in a television picture can be reduced.

Further, since a so-called center tap inductive element is provided, the oscillation carrier will not flow into the power source and ground and therefore a stable oscillation operation can be realised and it is

possible to prevent occurrence of a pseudo lock and high frequency beat even in a weak electric field.

Claims

1. An oscillator comprising:
   a differential type amplifier formed by first and second transistors (Q_2,Q_1);
   a resonance circuit (RSN_a), output terminals thereof being connected to bases of said first and second transistors (Q_2,Q_1); and
   a first inductive element (L_2) connected between said bases of said first and second transistors (Q_2,Q_1).

2. An oscillator as set forth in claim 1, further comprising a second inductive element (L_3) connected to said resonance circuit (RSN_a) in parallel, a point divided inductance thereof into substantially equal two values being grounded.

3. An oscillator as set forth in claim 1, further comprising a mixing circuit (MIX) having input terminals connected to output terminals of said amplifier, and a third inductance element (L_4) connected between an output terminal of said mixing circuit (MIX) and a frequency control terminal of said resonance circuit (RSN_a),
   wherein said resonance circuit (RSN_a) is driven by a signal which is phase-detected in response to an output signal of said amplifier in said mixing circuit (MIX) and is applied to said frequency control terminal through said third inductive element (L_4).

4. An oscillator as set forth in claim 3, wherein said frequency control terminal is connected to said second inductive element (L_3) in parallel.

5. An oscillator as set forth in claim 3, wherein said resonance circuit comprises at least first and second variable capacitive elements (VC_1, VC_2) oppositely connected in series, and
   wherein said frequency control terminal is provided at a point commonly connected said variable capacitive elements (VC_1, VC_2), to vary the capacitances of said first and second variable capacitive elements (VC_1, VC_2) in response to a signal from said second inductive element (L_4).

6. An oscillator as set forth in claim 2, further comprising a first capacitive element (C_6) connected between said base and emitter of said first transistor (Q_2) of said amplifier,
   a second capacitive element (C_5) connected between said base and emitter of said second transistor (Q_1) of said amplifier, and
   a third capacitive element (C_7) connected between said emitters of said first and second transistors (Q_2,Q_1).

7. An oscillator as set forth in claim 6, wherein said first and second capacitive elements (C_6,C_5) function as positive feedback capacitors, and
   wherein said third capacitive element (C_7) functions as a coupling capacitor.

8. An oscillator as set forth in claim 6, wherein said amplifier comprises a first current source (I_2) connected between said emitter of said first transistor (Q_2) and ground, and a second current source (I_1) connected between said emitter of said second transistor (Q_1) and ground.

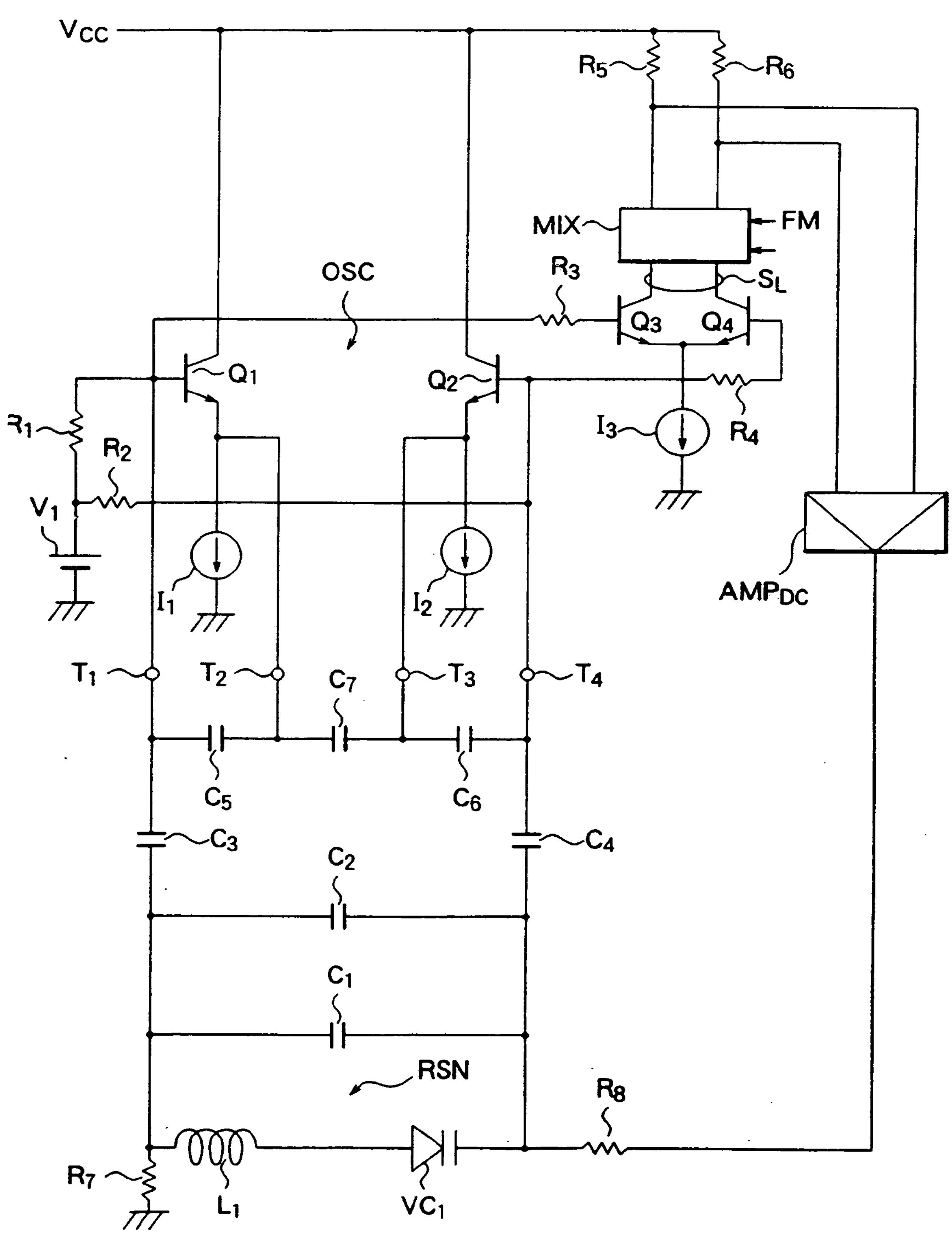
9. An oscillator as set forth in claim 8, wherein said amplifier comprises a voltage biasing circuit (R_1,R_2,V_1) connected to said bases of said first and second transistors (Q_2,Q_1).

10. An oscillator as set forth in claim 6, wherein said amplifier is formed as a differential Colpitz oscillation circuit.

11. An oscillator as set forth in claim 1, 3 or 5, further comprising a first capacitive element (C_6) connected between said base and emitter of said first transistor (Q_2),
    a second capacitance element (C_7) connected between said emitter of said first transistor (Q_2) and ground, and
    a third capacitive element (C_5) connected between said base of said second transistor (Q_1) and ground,
    a collector of said first transistor (Q_2) being connected to ground.

12. An oscillator as set forth in claim 11, wherein said first inductance element (L_2) has a point where inductance thereof is divided into substantially equal two values and is connected to ground.

FIG. 1


Vcc
R5
R6
MIX
FM
SL
R3
OSC
Q3
Q4
Q1
Q2
R1
R2
V1
I3
R4
I1
I2
AMPDC
T1
T2
T3
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C7
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C6
C3
C4
C2
C1
RSN
R8
R7
L1
VC1

FIG. 2

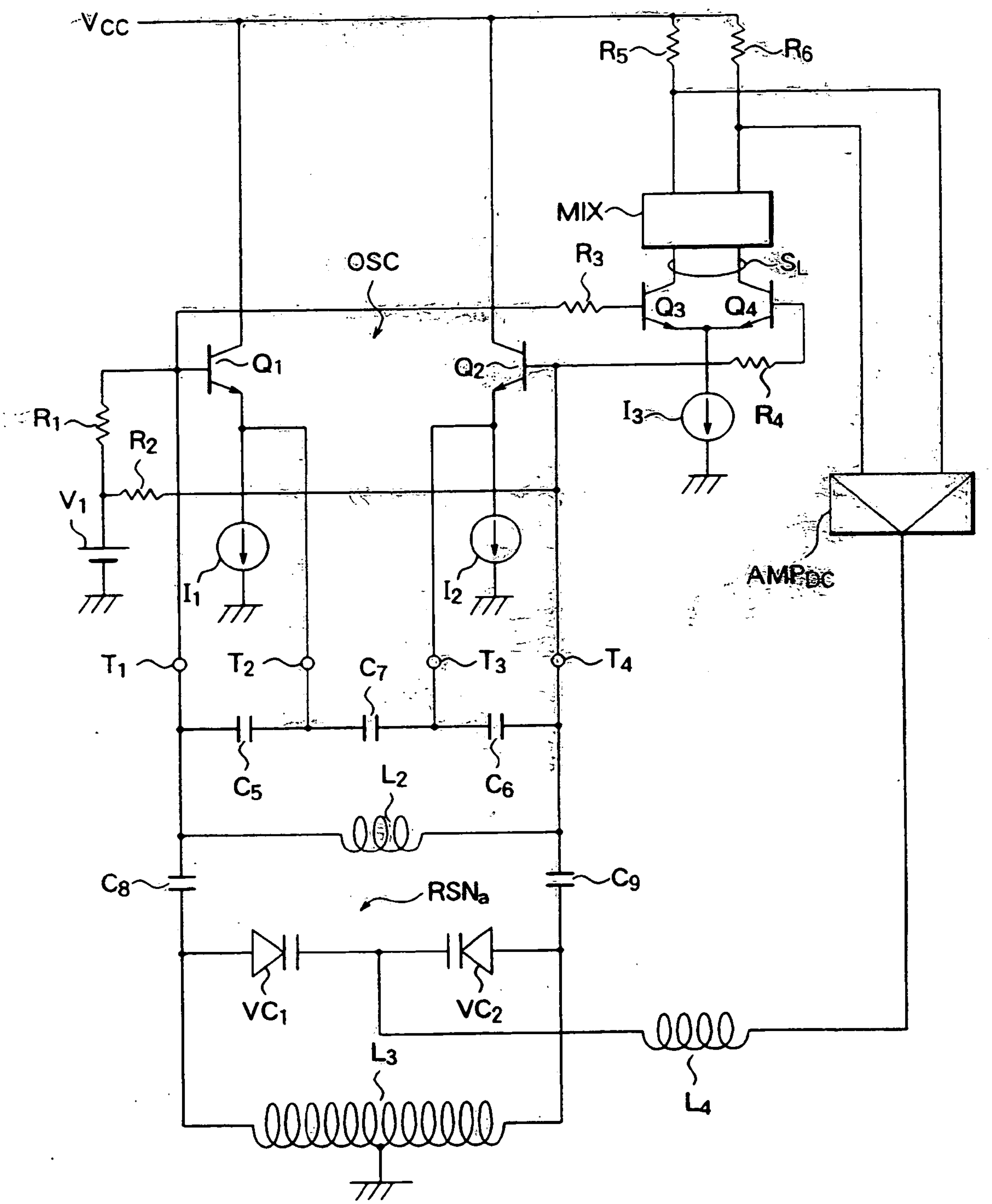
VCC
R5
R6
MIX
SL
R3
OSC
Q3
Q4
Q1
Q2
R4
I3
R1
R2
V1
I1
I2
AMPDC
T1
T2
T3
T4
C7
C5
C6
L2
C8
C9
RSNa
VC1
VC2
L3
L4

FIG. 3

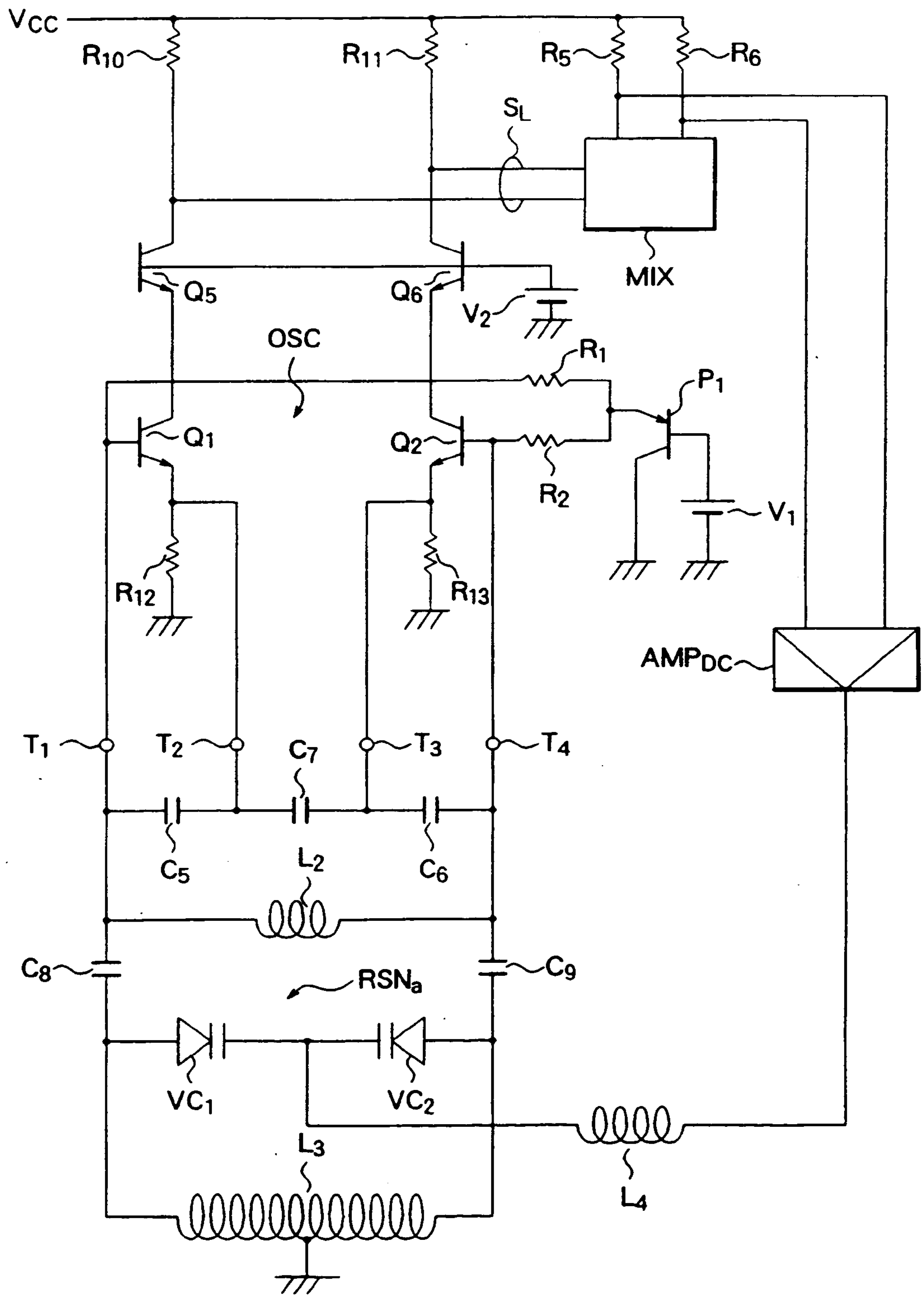
Vcc
R10
R11
R5
R6
SL
MIX
Q5
Q6
V2
OSC
R1
P1
Q1
Q2
R2
V1
R12
R13
AMPDC
T1
T2
C7
T3
T4
C5
L2
C6
C8
C9
RSNa
VC1
VC2
L3
L4

FIG. 1

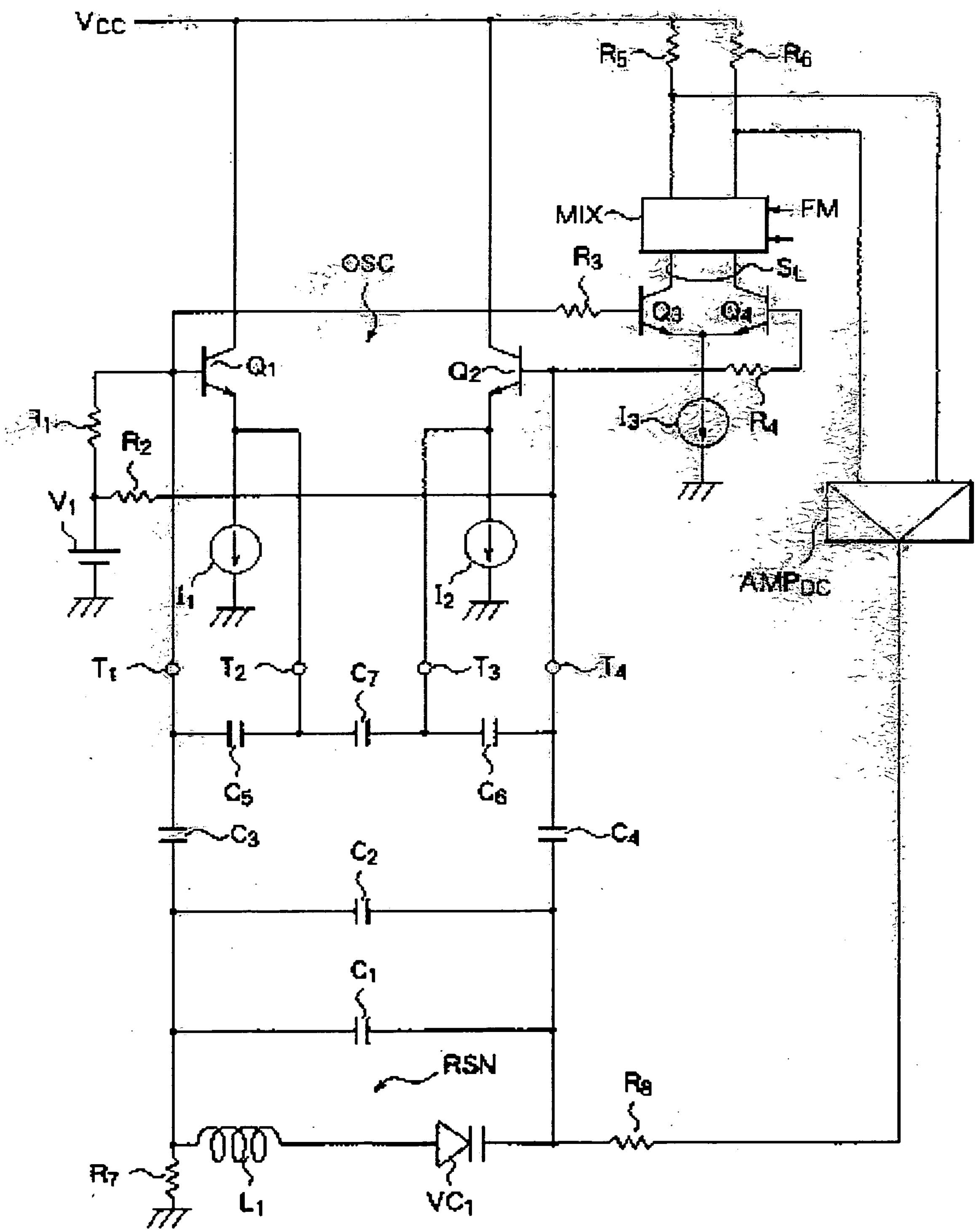
Vcc
R5
R6
MIX
FM
SL
OSC
R3
Q3
Q4
Q1
Q2
R1
R4
I3
R2
V1
AMPDC
I1
I2
T1
T2
T3
T4
C7
C5
C6
C3
C4
C2
C1
RSN
R8
R7
L1
VC1

FIG. 2

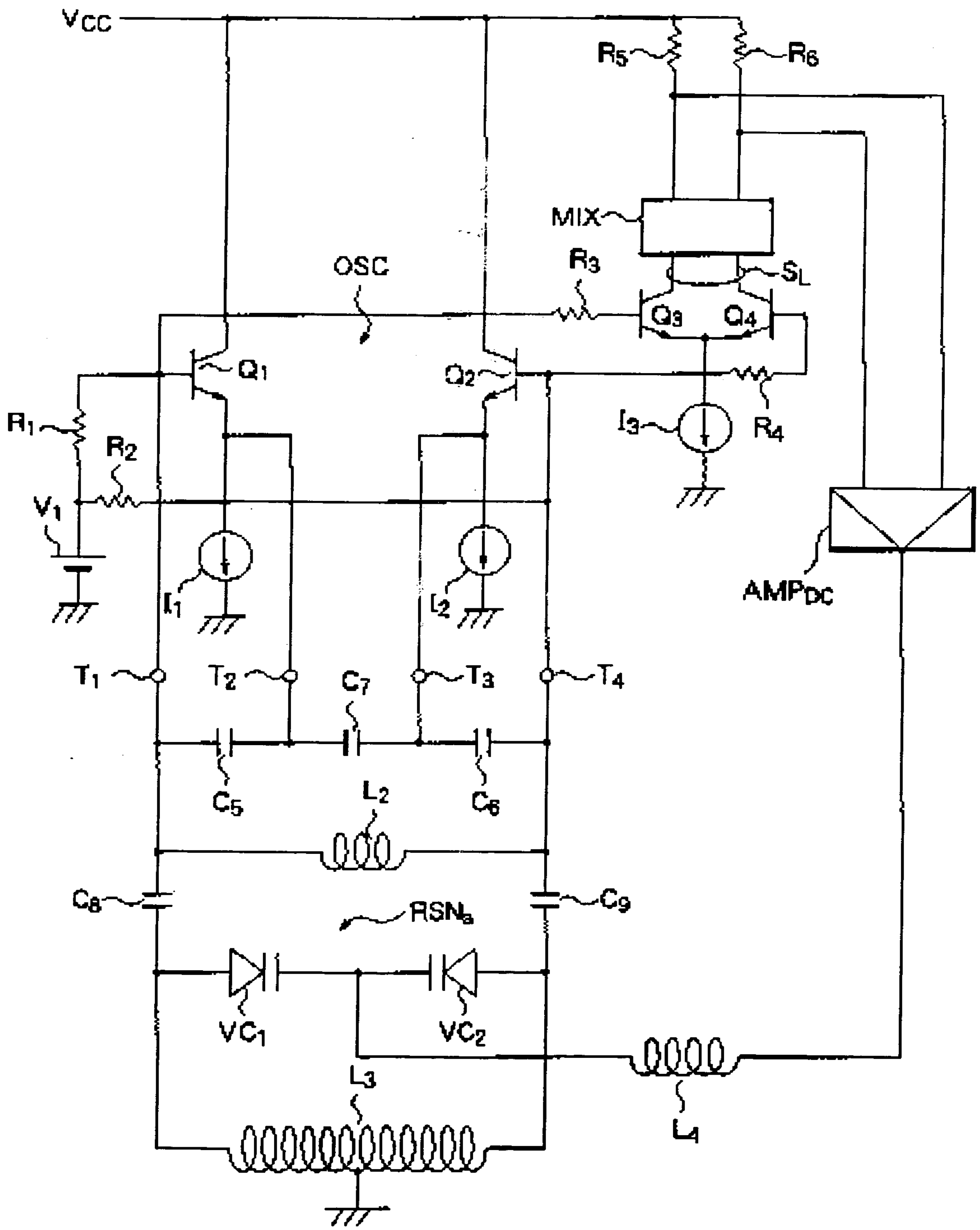
Vcc
R5
R6
MIX
SL
OSC
R3
Q3
Q4
Q1
Q2
R1
R2
V1
I3
R4
I1
I2
AMPDC
T1
T2
C7
T3
T4
C5
L2
C6
C8
C9
RSNa
VC1
VC2
L3
L4

FIG. 1

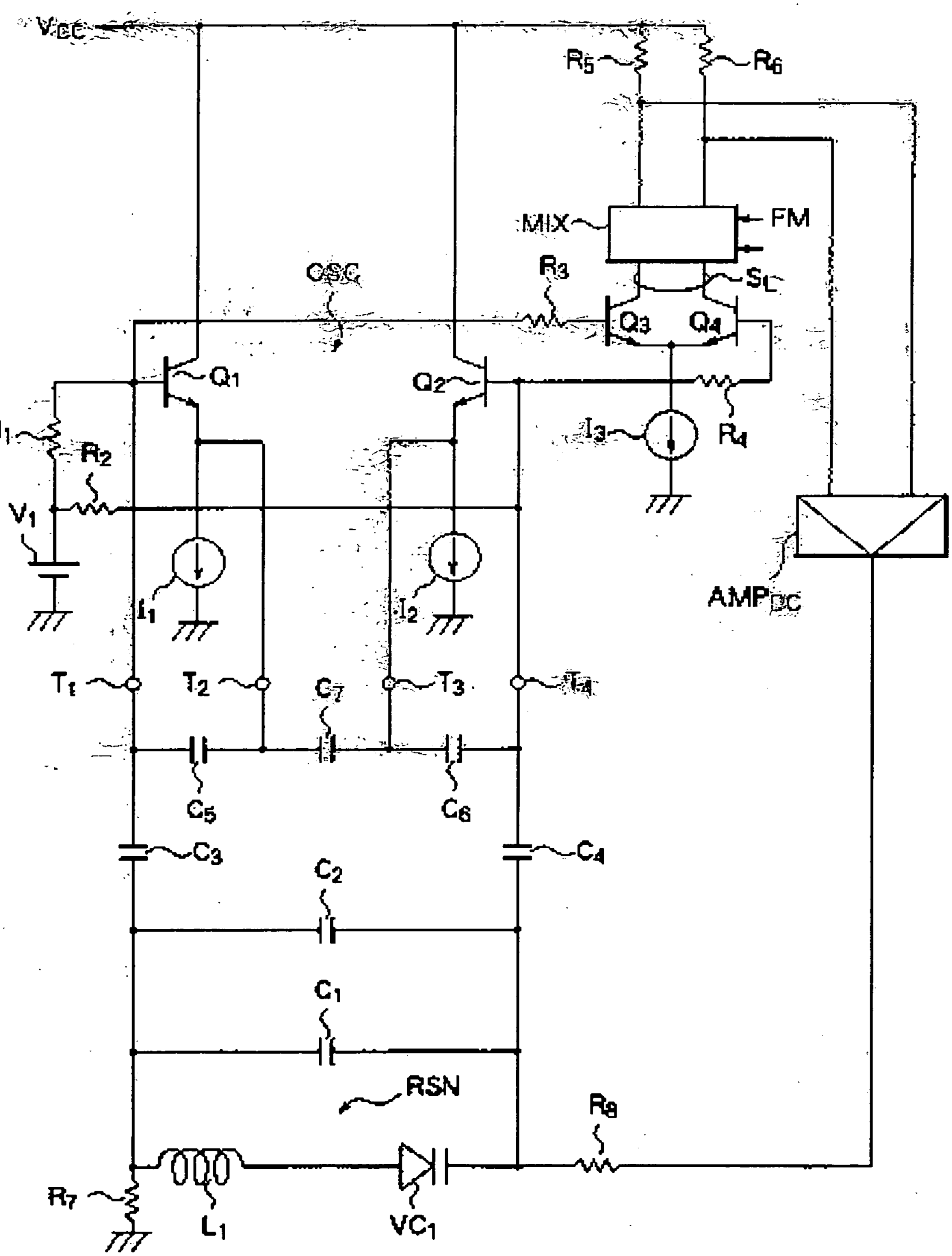
Vcc
R5
R6
MIX
FM
OSC
R3
SL
Q3
Q4
Q1
Q2
R1
R2
R4
I3
V1
I1
I2
AMPDC
T1
T2
C7
T3
T4
C5
C6
C3
C4
C2
C1
RSN
R8
R7
L1
VC1

FIG. 2

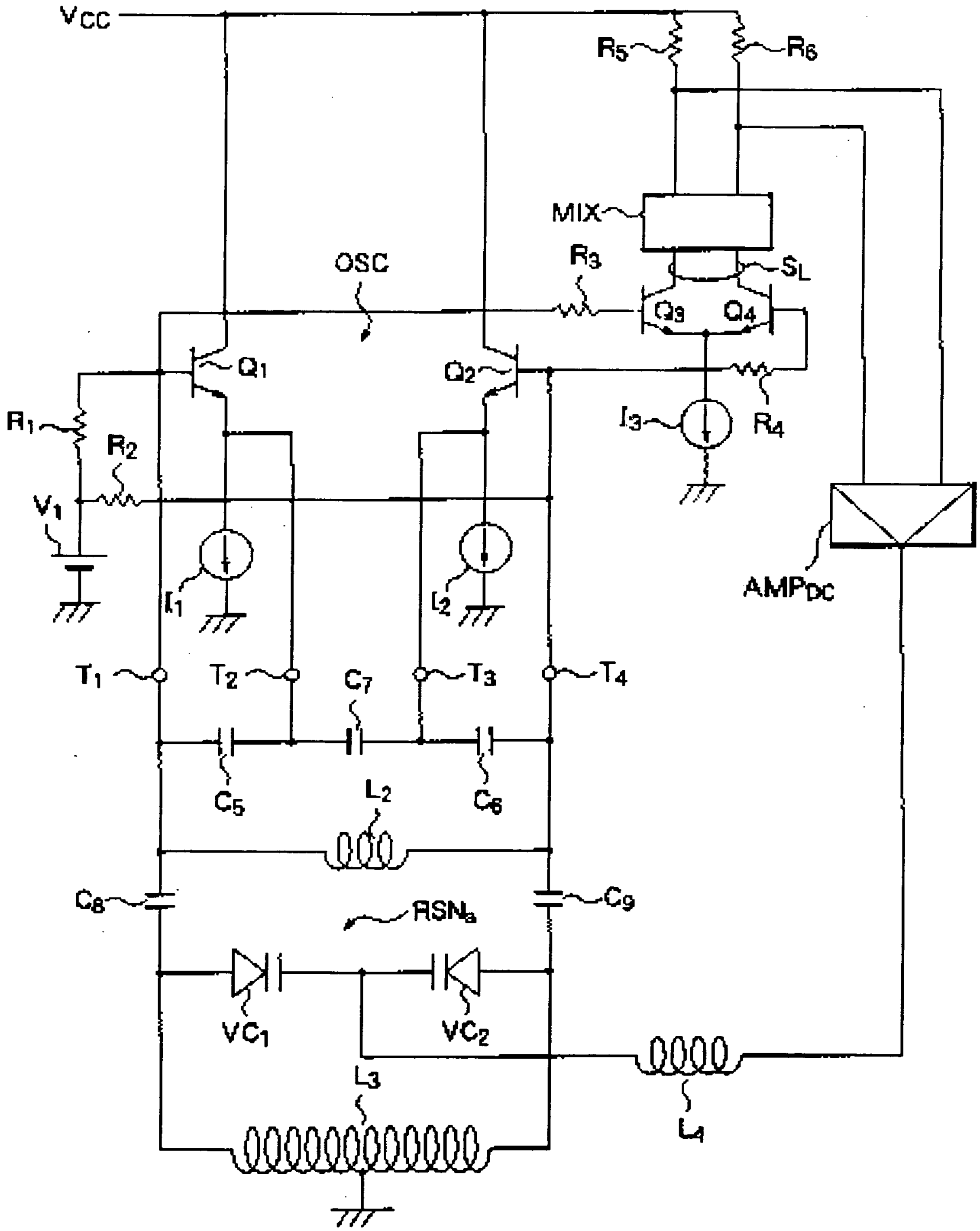
VCC
R5
R6
MIX
OSC
R3
SL
Q3
Q4
Q1
Q2
R1
R2
R4
I3
V1
I1
I2
AMPDC
T1
T2
T3
T4
C7
C5
C6
L2
C8
C9
RSNa
VC1
VC2
L3
L4

FIG. 3

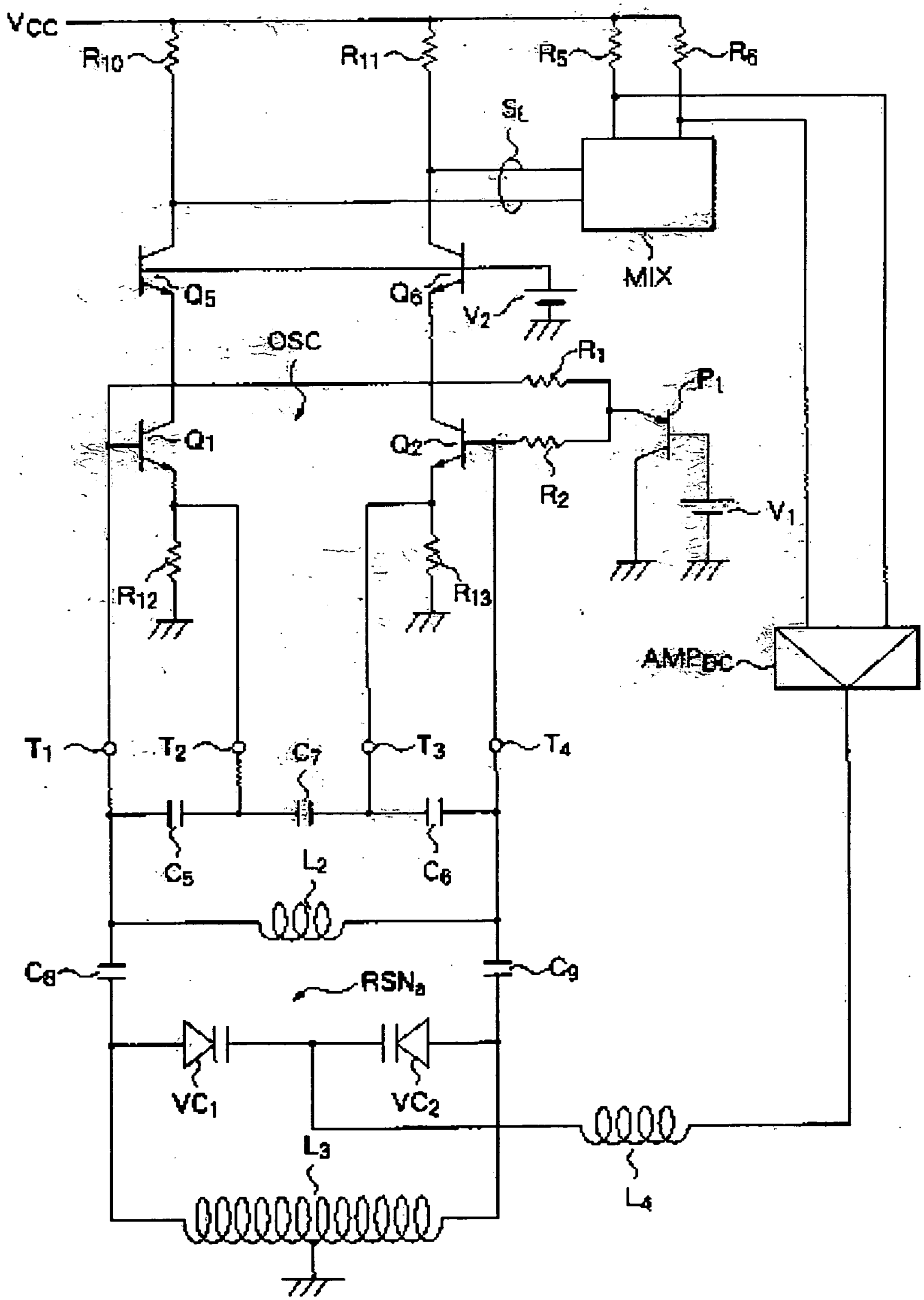
Vcc
R10
R11
R5
R6
SL
MIX
Q5
Q6
V2
OSC
R1
P1
Q1
Q2
R2
V1
R12
R13
AMPDC
T1
T2
C7
T3
T4
C5
L2
C6
C8
C9
RSNa
VC1
VC2
L3
L4

FIG. 4